



Czech Railways

Czech Railways Trials

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Content

- **Objectives of the APOLO trials**
- **Methodology**
- **Equipment & Facilities**
- **Results**



EC DG XIII's APOLO project (1998-2001)

APOLO consortium:

- DSNP (France), ERRI (Holland), RAILTRACK (U.K.), SAB WABCO (Italy), TIFSA/RENFE (Spain), CZECH RAILWAYS (CD)

APOLO trials were performed by CD and RENFE

Objectives of APOLO trials at CD:

- Install APOLO locator on two CD locomotives,
- Prepare track-side infrastructure (radio network along trial tracks, DGPS reference station, track surveying, ...etc)
- Perform tests



Equipment & Facilities



The electric locomotive 130 023-5 employed for GNSS-1/INS based APOLO field tests on the trial track no.1.

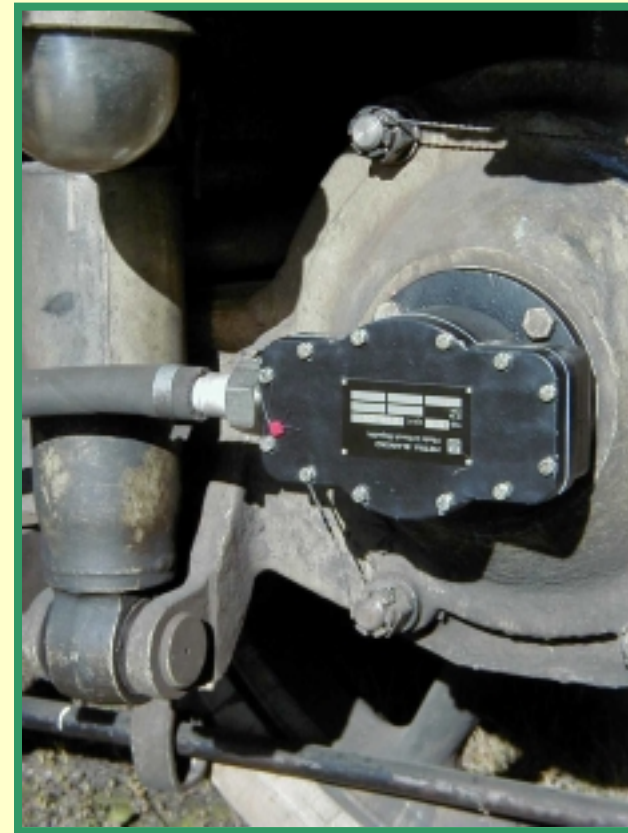


The radio modem and GPS/GLONASS antennas on the roof of the 130 023-5 locomotive.

Equipment & Facilities



The APOLO train position locator installed on the 130 023-5 electric locomotive.



The opto-electronic axle odometric sensor LTV14 of the 130 023-5 electric locomotive.



Equipment & Facilities



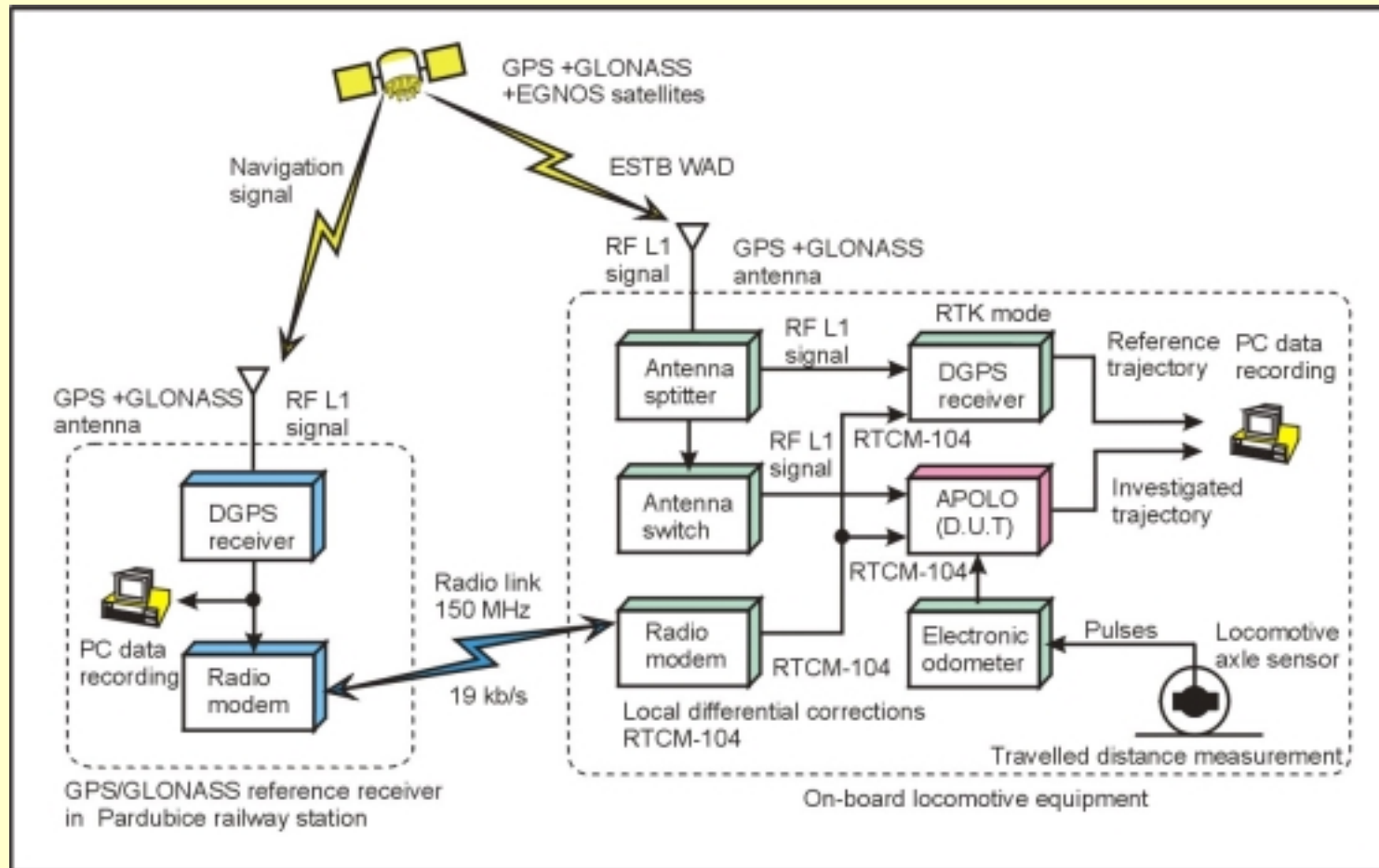
Measured data was recorded in the portable computers in the locomotive cabin during final APOLO trials.

Influence of the environmental effects on the performance of the APOLO locator has been investigated during long term operational field tests.

The 130 023-5 electric locomotive daily operates passenger trains on Pardubice-Hradec Kralove-Chocen line. Information on position of the train and other data are transmitted to the CD laboratory through a digital radio network which cover about 100 km of tracks.



Experimental set-up





Results of GNSS-1/ INS APOLO trials

APOLO trials were performed in three basic modes:

- GPS C/A,
- Differential mode WADGPS with ESTB WAD corrections
- Local mode LADGPS with RTCM-104 corrections

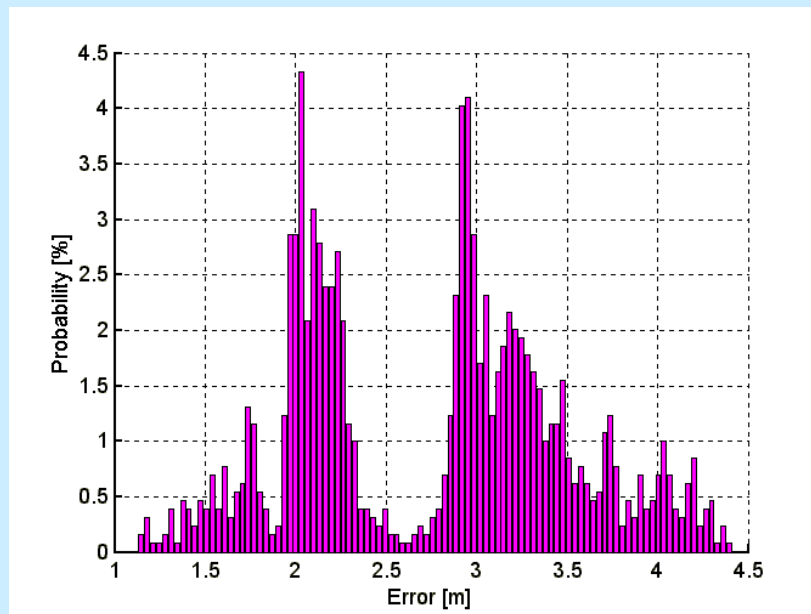
Achieved accuracy of the APOLO locator

		M O D E		
		GPS	Differential ESTB WADGPS (WAD)	Differential LADGPS (RTCM-104)
Accuracy		3 – 4 m	1 - 1.5 m	1 m

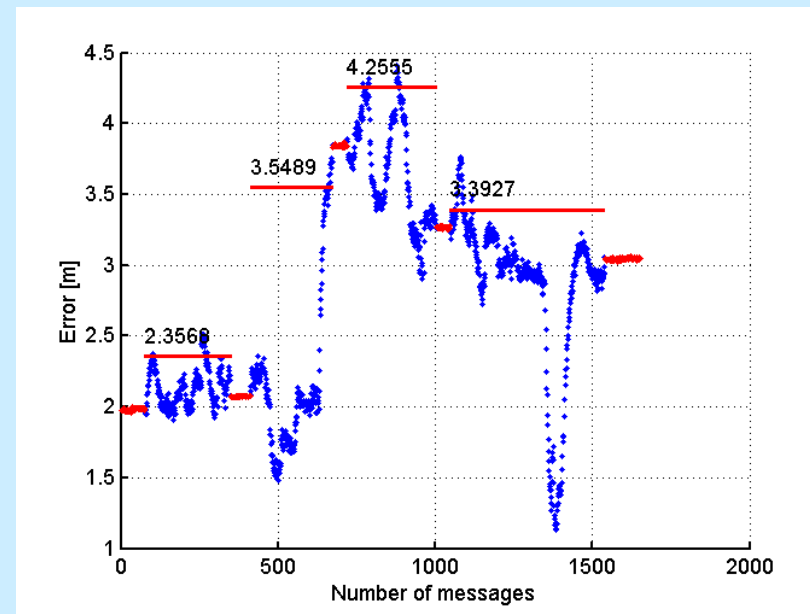


Results of GNSS-1/ INS APOLO trials

GPS C/A mode: accuracy (95%): 3-4 m



(a)



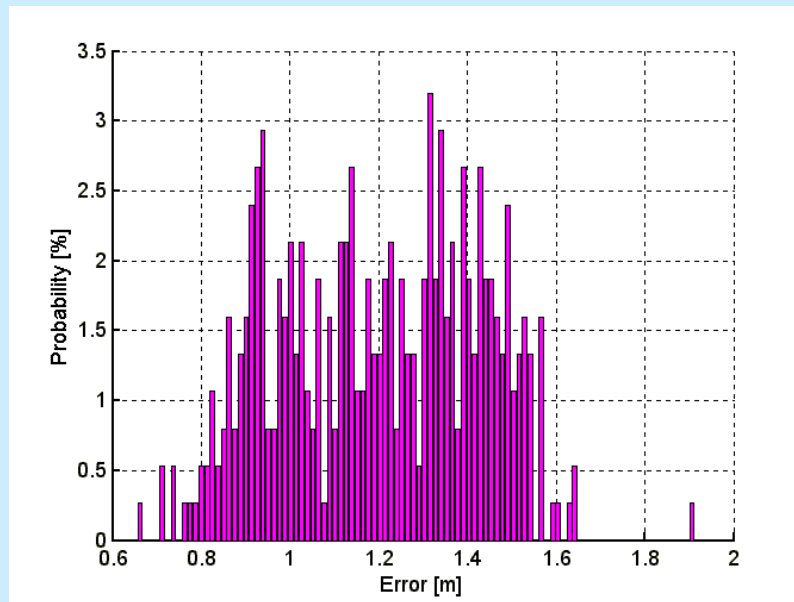
(b)

The accuracy of the APOLO locator in GPS C/A mode. (a) - Histogram: probability v.s. error in position, (b) - Error in position v.s. number of recorded messages.

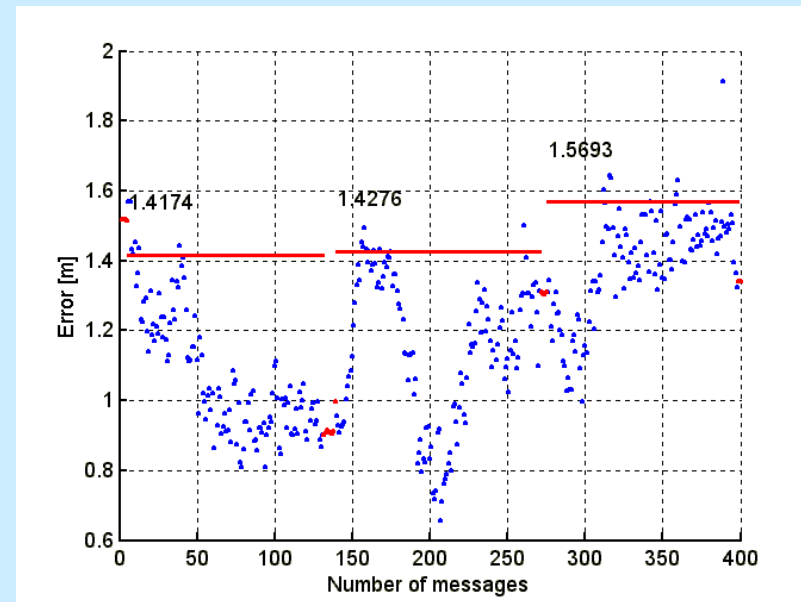


Results of GNSS-1/ INS APOLO trials

WADGPS (ESTB WAD) mode: accuracy (95%): 1-1.5 m



(a)



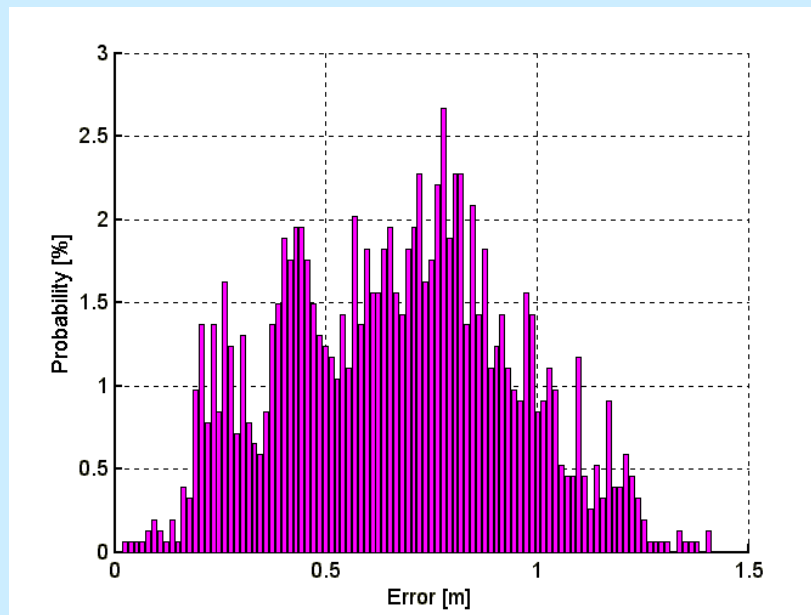
(b)

The accuracy of the APOLO locator in WADGPS mode. (a) - Histogram: probability v.s. error in position, (b) - Error in position v.s. number of recorded messages.

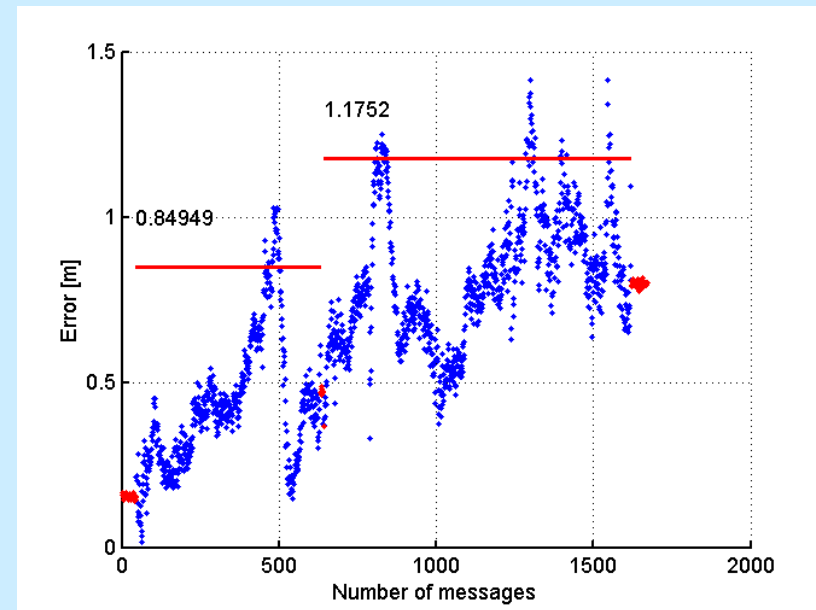


Results of GNSS-1/ INS APOLO trials

LADGPS mode : accuracy (95%): 1 m



(a)



(b)

The accuracy of the APOLO locator in LADGPS mode. (a) - Histogram: probability v.s. error in position, (b) - Error in position v.s. number of recorded messages.



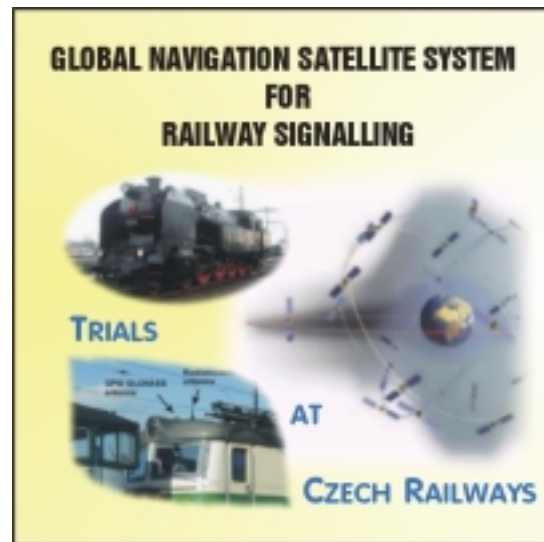
Current R&D

- Train positioning on a “dark” track
- Train routing detection on “dark” switches
(odometry + heading measurement + map matching)

Expected GNSS applications

- I. phase - Supervision system for dispatchers
- II. phase - Signalling systems for low-density lines

CD ROM already available !



Content

- Papers & presentations
- Photogallery with 59 photos illustrating experiments
- 4 video clips on field tests



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Thank you .



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